

IN THE CLAIMS:

Please cancel claims 1-3 without prejudice.

Claims 1-3 (canceled).

Please add new claims 4-36 as follows:

– 4. (New) A bioreactor apparatus and cell culturing system, comprising:

a reactor vessel rotatable about its axis including a cylindrical side wall connecting an upper cover plate and a lower cover plate, an upper rotary union providing an inlet for fluid communication with a fluid medium source, a lower rotary union including at least one outlet for medium and at least one outlet for medium and cells;

an electrical power source;

means for rotating said reactor vessel about its axis;

means for rotating one of said upper collector plate or said lower collector plate;

means for collecting fluid and cell samples;

means for delivering medium and circulating medium to and from said reactor vessel;

a sealed compartment for sample-collection bags providing a level of chemical containment for safety;

means for controlling the humidity within said reactor vessel;

a rotary sample collector in fluid communication with said reactor vessel; and

a computer program with graphical user interface for automatically and/or robotically controlling rotation of the reactor vessel, rotation of said upper plate with respect to said lower plate, controlling the feeding of fresh medium, controlling perfusing the reactor vessel, controlling taking timed collection samples of fluid from said reactor vessel, and selecting between collecting cells or cell-free supernatant.--

--5. (New) The bioreactor apparatus and cell culturing system of claim 4, said rotary sample collector comprising multiple sample collectors.--

–6. (New) The bioreactor apparatus and cell culturing system of claim 4 said rotary sample collector including the capability for collecting cells on filters, fixing the cells and collecting the cells.--

–7. (New) The bioreactor apparatus and cell culturing system of claim 5, said rotary sample collector including multiple sample collectors having the capability for collecting cells on filters, fixing the cells and collecting the cells.--

–8. (New) The bioreactor apparatus and cell culturing system of claim 3, including fluid connection means for allowing the entrance of fresh or recycled fluid, and the optional removal of: spent medium, medium to be recycled , filtered medium, unfiltered medium, and combinations thereof for the collection of samples.--

–9. (New) The bioreactor apparatus and cell culturing system of claim 3, wherein said means for exchanging gases between the culture medium and ambient gases comprises a user-selected length of permeable tubing and a peristaltic pump.--

–10. (New) The bioreactor apparatus and cell culturing system of claim 3, further comprising a low pressure drop filter for preventing cells from exiting the reactor when fluid is withdrawn through a selected one of the two outlets in the lower rotary union.--

–11. (New) The bioreactor apparatus and cell culturing system of claim 3 further comprising a polymeric fresh-medium storage bag in fluid communication with said peristaltic pump for batch feeding, perfusion or sample collection.--

–12. (New) The bioreactor apparatus and cell culturing system of claim 3, further comprising a manifold and a series of pinch valves in fluid communication with said sealed compartment for sample collection bags for the periodic collection of samples of suspended cells or cell-free medium.--

--13. (New) The bioreactor apparatus and cell culturing system of claim 3, wherein said means for controlling the humidity comprises a humidity control system consisting of a polymeric porous matrix and a fan;

--14. (New) The bioreactor apparatus and cell culturing system of claim 3, wherein said rotary sample collector further comprises means for rotating inlet into a compartment with a filter, means to remove waste liquid from an input cell suspension, means for collecting cells in chambers in liquid suspension, and means to store fixed cells for later recovery and examination. --

--15. (New) The bioreactor apparatus and cell culturing system of claim 3, including means for oxygenation of medium in said reactor.--

--16. (New) The bioreactor apparatus and cell culturing system of claim 3, further including analytical sensors for measuring the pH, glucose, and oxygen of said medium.--

--17. (New) The bioreactor apparatus and cell culturing system of claim 3,

--18. (New) The bioreactor apparatus and cell culturing system of claim 10, wherein said low pressure drop filter is a polymeric filter.--

--19. (New) The bioreactor apparatus and cell culturing system of claim 3, further comprising a method of preventing cell capture on said drop filter. --

--20. (New) The bioreactor apparatus and cell culturing system of claim 3, further comprising a video camera or video device and microscope system.--

--21. (New) The bioreactor apparatus and cell culturing system of claim 20, wherein said video camera system comprises a color camera and a dual optical path configuration allowing for a first observation of the rotating cell growth reactor contents with a 20 x 25mm Field Of View

(FOV) and a second microscopic observation path providing an approximately 5-micron resolution of cell samples that have been extracted from the bioreactor and pumped into the observation cell.--

-22. (New) The bioreactor apparatus fo claim 21, wherein said digital camera and/or video device shows instantaneous or still frame pictures.--

-23. (New) The bioreactor apparatus fo claim 20, further comprising a modular slide system for stopping the flow of medium for microscopic observation and photographing.--

-24. (New) The bioreactor apparatus of claim 3 further comprising LEDs for providing uniform light to said reactor.--

-25. (New) The bioreactor apparatus of claim 23 further comprising LEDs for providing uniform light to said microscopic observation slide.--

-26. (New) A bioreactor apparatus and cell culturing system, comprising:  
a reactor vessel;  
an electrical power source;  
means for collecting fluid and cell samples;  
means for delivering medium and circulating medium to and from said reactor vessel;  
a computer program with graphical user interface for automatically and/or robotically controlling said reactor vessel;

a video camera or video device and microscope system wherein said video camera system comprises a camera and a dual optical path configuration allowing for an observation of said cell growth reactor contents and a second microscopic observation path a micron resolution of cell sample.--

-27. (New) A fully-enclosed, closed-loop automated bioreactor and cell-culture system comprising:

a reactor vessel that may be optionally rotated about its axis while said vessel is a component of a closed fluid loop culturing cells;

said reactor vessel is sterilizable by sterilization means including autoclaving;

said closed fluid loop includes means for storing and delivery of a fresh medium and reagents to said reactor vessel;

containers serving as receptacles for spent medium, samples of suspended cultured organisms, and samples of filtered medium for analysis; and

flexible tubing connecting said containers to at least one inlet and at least one outlet of said reactor vessel and serving as means of exchanging gases between said medium and ambient gas environments.--

--28. (new) The bioreactor and cell-culture system according to claim 27, wherein said reactor vessel comprises at least one cylindrical wall and opposing end cover plates, at least one rotary unions sealed in fluid communication with end cover plates and at least two external tubing connectors that articulate the reactor vessel with said closed loop.--

-- 29. (New) The bioreactor and cell-culture system according to claim 27 wherein fluid movement within said closed loop is effected by at least one peristaltic, shuttle or similar pumps that act upon the tubing of the closed loop and do not contact the fluid directly.--

-- 30. (New) The bioreactor and cell-culture system according to claim 29 wherein said fluid movement is controlled by at least one electronically controlled pinch valves that acts upon the tubing of the closed loop and does not contact the fluid directly.--

-- 31. (New) The bioreactor and cell-culture system according to claim 27 wherein said closed-loop bioreactor system is fully enclosed in a first sealed compartment providing a level of chemical containment for safety and in which containers used for sample collection are optionally enclosed within a second sealed container within said first sealed container for one additional level of chemical containment and therefore triple chemical containment for safety.--

-- 32. (New) The bioreactor and cell-culture system according to claim 27 wherein said closed fluid loop includes a plurality of lines providing access for the addition of external fluids to said closed loop and the removal of waste and samples from said closed loop without violating two levels of chemical containment for safety, for making chemical measurements on line, for collecting and fixing cells automatically for immediate observation by an optionally included microscope, and for collection in sample containers.--

-- 33. (New) The bioreactor and cell-culture system according to claim 27 further comprising means for measuring the pH and dissolved oxygen content of said medium from said reactor vessel.--

-- 34. (New) The bioreactor and cell-culture system according to claim 27 further comprising a computer including programming for conducting sequences of experimental procedure requiring pumping, valving, chemical measurement, reactor rotation rate, microscope operation without operator intervention or with optional operator intervention.--

-- 35. (New) The bioreactor and cell-culture system according to claim 27 wherein said bioreactor and cell-culture system is capable of functioning in low gravity and that fulfills safety requirements for manned space flight.--

-- 36. (New) The bioreactor and cell-culture system according to claim 27 further comprising:

a microscope system for observing suspended cells or organisms within said bioreactor vessel, said microscope system comprising

an inlet from a branch of the closed loop coupled to a holder for a hollow microscope slide, a hollow microscope slide made of glass or fabricated by photo polymerization, a light-microscope objective compound lens, a video plane, an outlet for the removal of samples of fluid after observation, and reservoirs for the addition of reagents to cell suspensions when said reagents are required for observation.--